

Warn on Forecast and the NSSL Hazardous Weather Testbed

Outline:

- I. 3DVAR Analyses
- II. EFP WoF Activities (“Spring Program”)
- III. Data Collection / Sharing (FTP Server)
- IV. Radar QC
 - I. Manual
 - II. Automated
- V. URDF(?)

NSSL Modeling and Assimilation Program

- **2010 Deliverables**

- Completion of VORTEX2 field phase data collection activities.
- Quality controlled and supplemental data sets for 5 June 2009 VORTEX2 case
- Summary report for automated radar QC
- Report on the CAPS real-time 3DVAR with assessment of system by forecasters and archive of results.
- New federal scientist hired to assist in data assimilation activities.
- Warn-on-forecast webpage completed and online.
- Other deliverables to be discussed elsewhere

3D VAR Analyses

Running (quasi) realtime 3DVAR analysis

3 Auto-updating domains based on **Max Reflectivity from CONUS Composite**

1 User controlled domain (via GUI)

Data assimilated and analyses produced every 5 minutes

5 minute update cycle

2 minute processing time

Output displayed in WDSSII for user interaction

2D displays

3D displays

Model output combined with radar as “overlays”

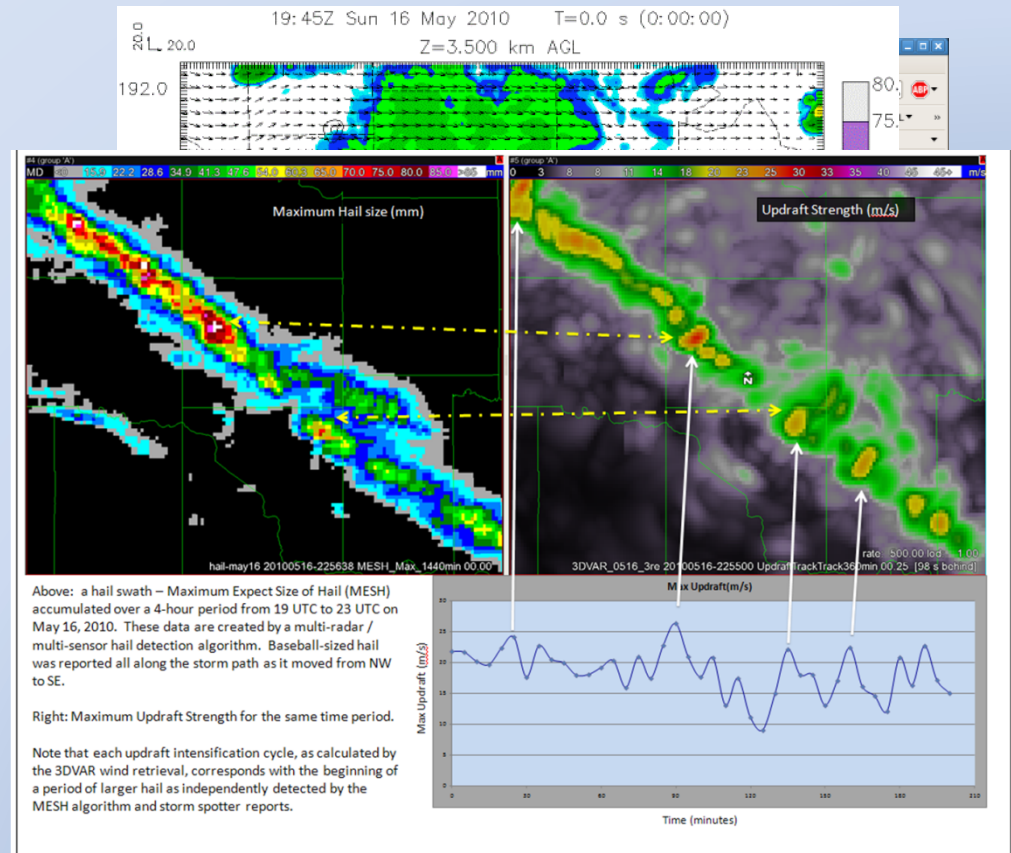
Data mining on 3DVAR analyses products and compared to Multi-Radar products

Vorticity Track vs “RotationTracks”

Updraft strength vs MESH

2010 cases:

20100420 20100501 20100516 20100525 20100610 20100616
20100424 20100510 20100519 20100531 20100611 20100620



3D VAR Analyses

Post processed results to be displayed to users in near-realtime
In 2010, 3DVAR analyses were presented to forecasters in a
“post event” debrief

2D fields displayed in AWIPS2

Additional data mining

Publications (Conference Papers):

Stensrud, David J., J. Gao, T. M. Smith, K. Manross, J. Brogden, and V. Lakshmanan, 2010: A realtime weather-adaptive 3DVAR analysis system with automatic storm positioning and on-demand capability. *Extended Abstracts, 25th Conference on Severe Local Storms*, Denver, CO, USA, AMS, 8B.1.

Smith, T. S., K. M. Kulman, K. L. Ortega, K. L. Manross, D. W. Burgess, J. Gao, D. J. Stensrud, 2010: A survey of real-time 3DVAR analyses conducted during the 2010 Experimental Warning Program spring experiment. *Extended Abstracts, 25th Conference on Severe Local Storms*, Denver, CO, USA, AMS, P5.7.

EFP WoF Activities

2010 Review

WoF Emphasis in the EFP focused on fundamental modeling challenges:

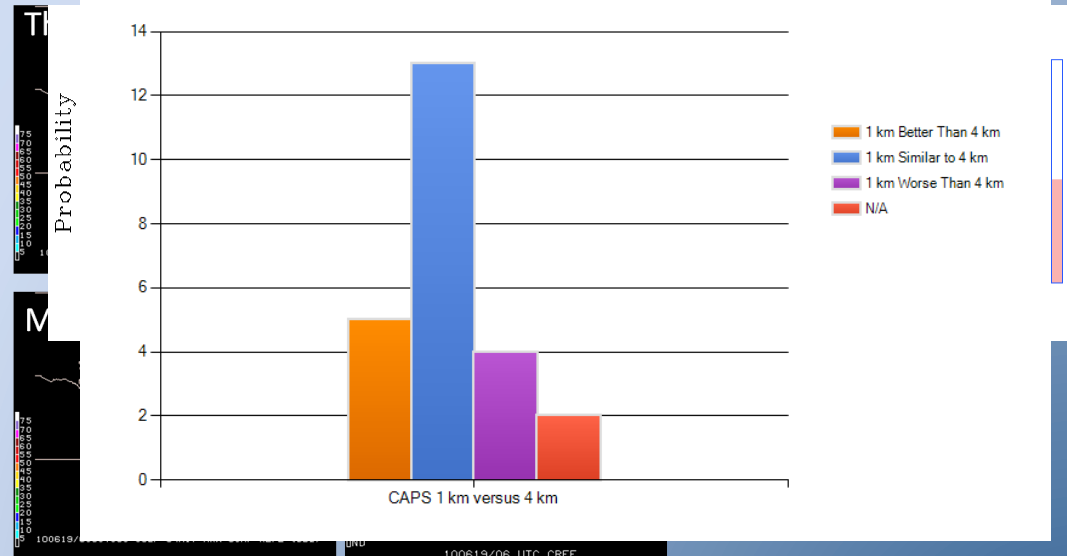
- *Model initialization*
- *Physics sensitivity and systematic biases*
- *Ensemble dispersion*
- *Sensitivity to model grid-spacing*

"Did observations fall within range of

1-km vs. 4-km runs were compared each day

under-dispersive.

Compare hourly forecasts from yesterday's 1 km and 4 km WRF-ARW forecasts from CAPS. Use the web-based 6-panel display to focus on the 20Z - 04Z time period, the 1 km AGL simulated reflectivity fields from the model, and the observed base reflectivity product. Assess how well the model reflectivity forecasts correspond to the mesoscale evolution of convection within the evaluation domain, including initiation, direction and speed of system movement, areal coverage, configuration and orientation of mesoscale features, and perceived convective mode. How does the 1 km model forecast compare to the 4 km version?



Publications:

Recently submitted overview article of the 2010 EFP Spring Experiment to BAMS

Data Collection

Current repository is NSSL FTP Server

< <http://ftp.nssl.noaa.gov/projects/warnonforecast> >

- Very basic
- “One stop shop”
- “pull” only
- No Searchability
- Currently limited to NSSL upload (WoF users outside NSSL currently have no **easy** way to upload data)
- 5 June 2009 (LaGrange/Goshen V2 Case as example)

Consider Repository/Server with:

Revisioning

Searchability

Backup

Sharing (all users can share/upload)

Radar QC - Manual

Had/have two students performing manual QC on WSR-88D data

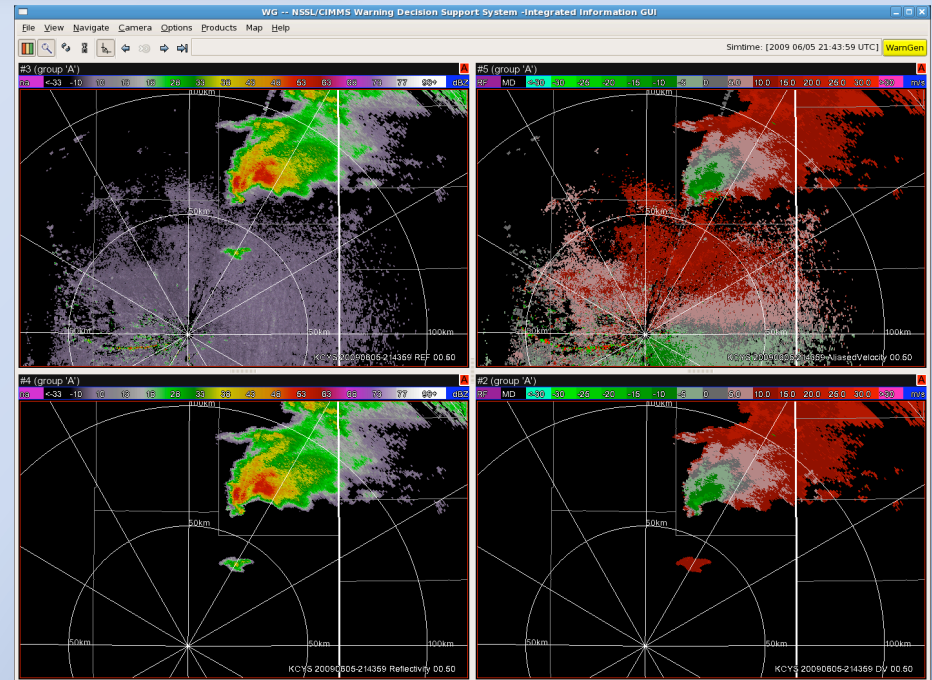
Eventually settled on SOLOii as editing tool

Manually edited cases can/will be used as:

- “clean input” for data assimilation
- “Truth” case to compared with automated radar QC techniques

Cases:

- 5 June 2009 (KCYS/KFTG) [completed]
- 11 June 2009 (KPUX/KGLD) [under way]



Event	Radar	Volume Scans	Elevation Scans	Time Period (UTC)	Processing Time
20090605 (LaGrange/Goshen WY)	KCYS	40	560	205811-000038	~ 5 hrs / VS*
	KFTG	36	504	211423-000125	
20090611	KGLD				
	KPUX				

* - Super-Resolution VCPs, and after familiarization with SOLOii

Warn on Forecast Workshop 23 Feb 2011

Radar QC - Automated

Automated Radar QC techniques

Formal literature review provided 5 automated technique candidates to improve radar data quality (next slide)

(search still ongoing for unpublished techniques that may be viable candidates)

Automated radar QC techniques to be implemented in WDSSII

May use techniques together (“daisy-chain”) or attempt to determine best technique

Compare output to manual QC cases and quantify results

[PLEASE SEE ME AFTERWARD IF YOU HAVE ADDITIONAL SUGGESTIONS FOR AUTOMATED RADAR QC TECHNIQUES!!!!]

Experimental / Non-operational Automated Data Quality Techniques

Label	Reference	Concept	Z/V	Strengths	Weaknesses
QCNN	Lakshmanan, V., A. Fritz, T. Smith, K. Hondl, G. J. Stumpf, 2007: An automated technique to quality control radar reflectivity data. <i>J. Appl. Meteor.</i> , 46 , 288-305.	Neural-net to distinguish between good and bad echoes	Z/V	Robust and , and can incorporate neighboring radars; holistic approach for spatial contiguity	Takes a while to train neural net; multi-radar errors are additive; may need to be retrained for climatology
AR-VAD	Qin Xu, Kang Nai, Li Wei, Pengfei Zhang, Shun Liu, David Parrish, 2010: A VAD-Based Dealiasing Method for Radar Velocity Data Quality Control. <i>Journal of Atmospheric and Oceanic Technology</i> , early online release	hi-res VAD, essentially performed at each gate	V	Good correction without false dealiasing	Rejects data in sharp inversions; requires adequate data coverage for VAD (fails at long range isolated cells)
2D-Dealias	Jing, Zhongqi, Gerry Wiener, 1993: Two-Dimensional Dealiasing of Doppler Velocities. <i>J. Atmos. Oceanic Technol.</i> , 10 , 798-808.	2D least mean squares run on entire elevation scan	V	Simple; removes "noisy" velocity fields (seen in upper tilts); being implemented by NEXRAD	Assumption of smooth field; fails in strong shear (though upgraded improvement)
AP-Remove	Steiner, Matthias, James A. Smith, 2002: Use of Three-Dimensional Reflectivity Structure for Automated Detection and Removal of Nonprecipitating Echoes in Radar Data. <i>J. Atmos. Oceanic Technol.</i> , 19 , 673-686.	Use 3D structure to determine precipitating echoes from AP	Z/V	Works well in precip, and sea clutter	Struggles with widespread/strong clear air echo; removes fine features such as gust fronts
CREM	V. Lakshmanan, J. Zhang, K. Hondl, and C. Langston, "A statistical approach to mitigating persistent clutter in radar reflectivity data," <i>J. Applied Meteorology</i> , vol. s, p. subm, s 2010.	Realtime clutter map collected during non-clear air sensing	Z/V	Adaptable; rerun periodically to update clutter maps	Clutter map needs to probably be run frequently in transition seasons

Unified Radar Data Format

Probably needs to be renamed “Agreed Upon Radar Data Format”

Born out of need to efficiently/effectively share radar data among WoF users

Avoid reinventing the wheel - if possible

Assimilators use format “V, W, or X”

Current paradigm is to use WDSSII to implement automated radar QC techniques – uses format “Y”

Turns out most use some form of netCDF. (DORADE sweep file is another possibility)

Agreed upon format is to encourage WoF participants to aim for
FORAY-style netCDF
(will post documentation to WoF Wiki)

Decision based on

- assimilation users’ input format of choice
- ability to modify netCDF with relative ease
- Supported active container/API

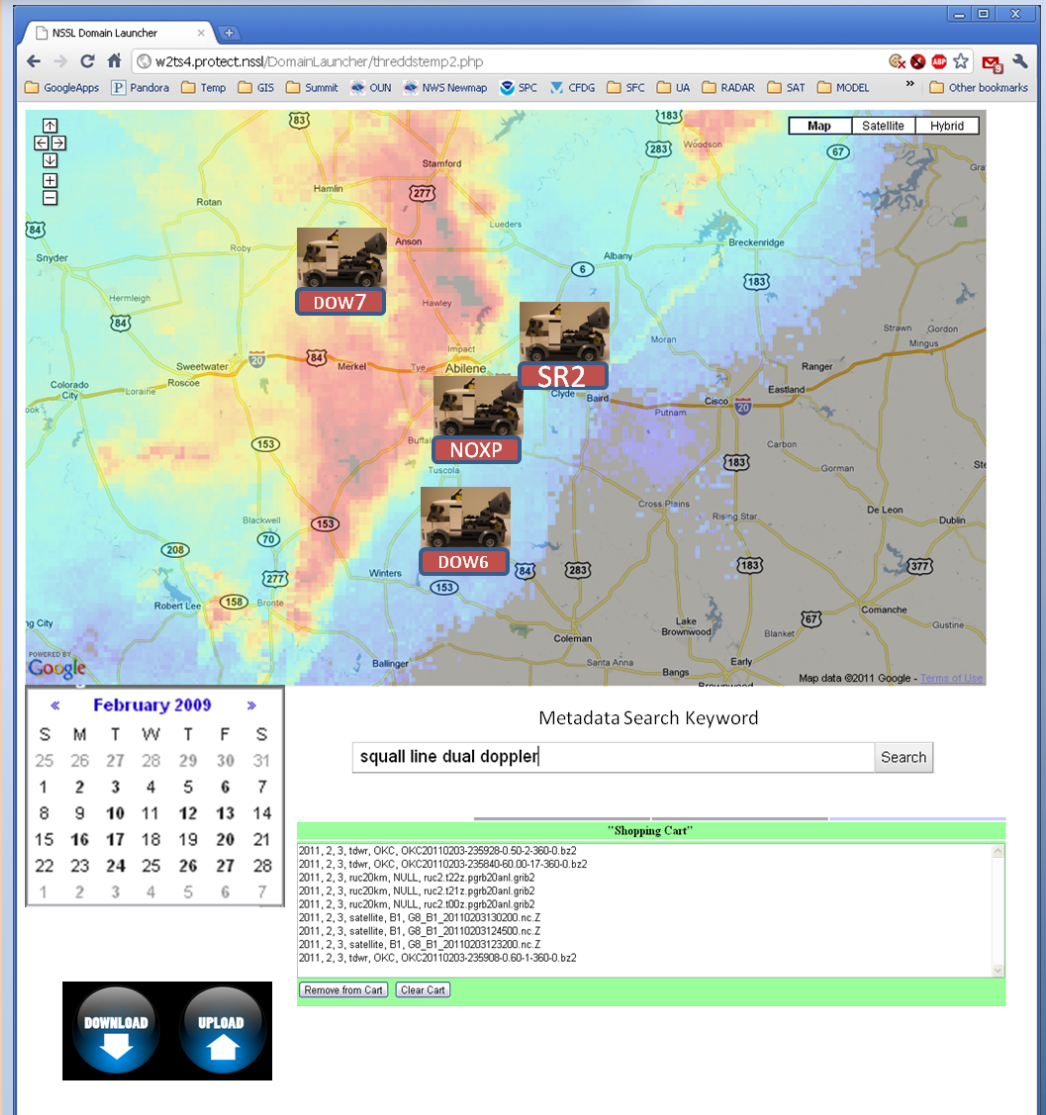
Will be writing netCDF translators for WDSSII I/O

May consider CfRadial at some point (URL)

Radar Data Format & Repository

Crossing the *Radar Data Format* and *Data Collection/Sharing* categories...

- Server/ repository would have tool(s) to allow users to upload data in “native format” (whatever the participant is used to working in; probably a “restricted” list of “common” radar data formats) and server would translate that into the common FORAY1 – netCDF format
- Both user-uploaded and FORAY-netCDF formats available
- Users who upload data are required to provide “physical metadata” (information about collected data not embedded the data) in standardized format (XML?)
- Repository would be searchable by date/ category / location / “physical metadata”



Questions / Discussion

